United States Patent [19]

Greenebaum, II

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[54] **MOUNTING CUP**

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[73] Assignee: **Pittway Corporation,** Cary, Ill.

[*] Notice: The portion of the term of this patent subsequent to Dec. 20, 2005 has been disclaimed.

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Related U.S. Application Data

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[51] **Int. Cl.**[4] **B65D 6/34;** B65B 7/28

[52] **U.S. Cl.** **222/394;** 220/67; 53/488

[58] **Field of Search** ..... 222/402.1, 402.21, 402.22, 222/402.23, 402.24, 402.25, 542, 402.16, 402.2, 394; 413/7, 42–44, 58–62; 53/470, 330, 488–489; 220/67, 81 R

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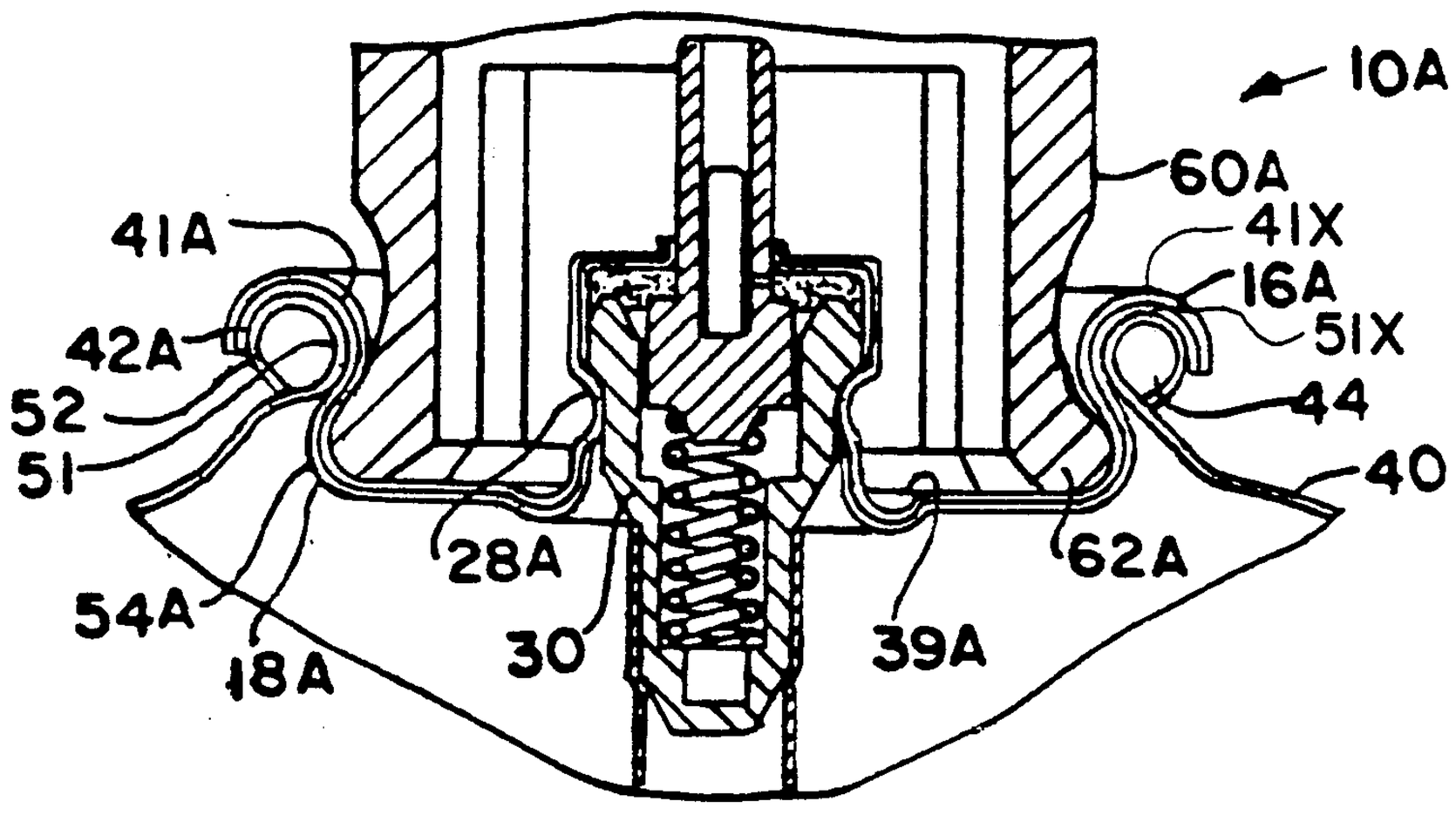
Primary Examiner—Michael S. Huppert
Attorney, Agent, or Firm—Frijouf, Rust & Pyle

[57] **ABSTRACT**

An apparatus and method is disclosed for an improved mounting cup for sealing with a container of an aerosol device. The container includes an annular bead extending about an opening in the container with the annular bead defining an internal surface contour having a generally partially circular cross-section. A mounting cup comprising a peripheral rim is formed for sealing with the annular bead of the container. The peripheral rim has an inner region contour substantially different in shape from the inner surface contour of the annular bead of the container. The inner region contour of the peripheral rim engages with the inner surface contour of the annular bead to allow only a portion of the peripheral rim of the mounting cup to contact the annular bead of the container when the mounting cup is disposed on the container. The inner region contour of the peripheral rim is deformed when the mounting cup is crimped to the annular bead of the container to reform the inner region contour of the peripheral rim to be substantially the same shape as the inner surface contour of the annular bead to provide a sealing engagement between the mounting cup and the container.

6 Claims, 4 Drawing Sheets



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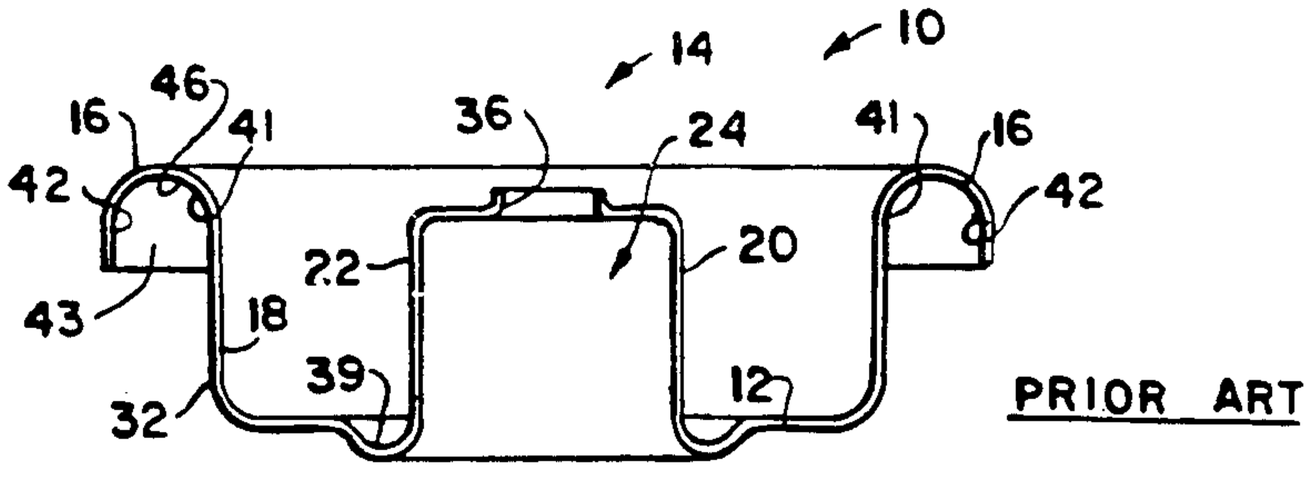

FIG. 1

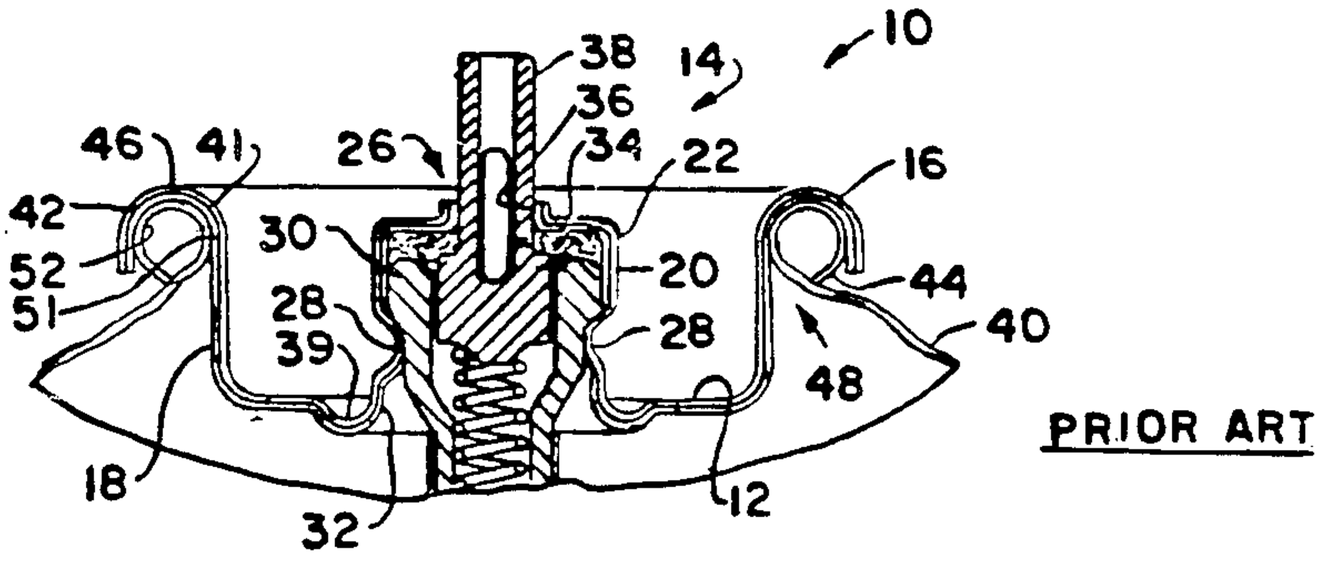

FIG. 2

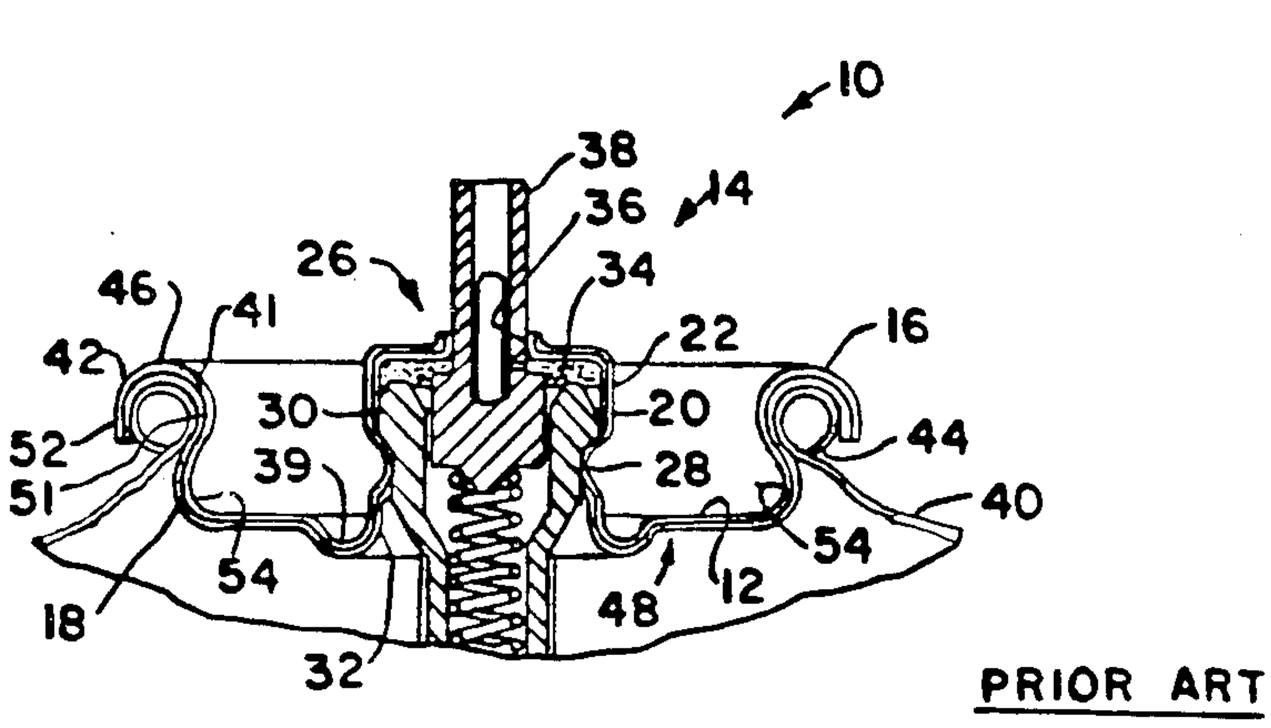

FIG. 3

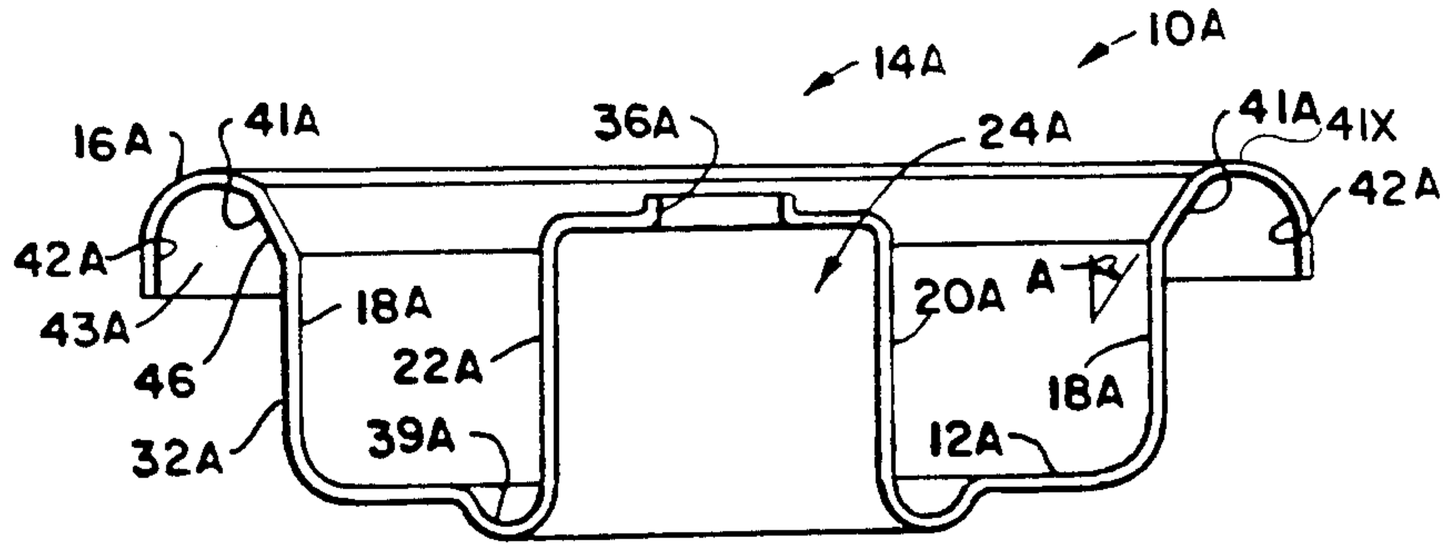

FIG. 4

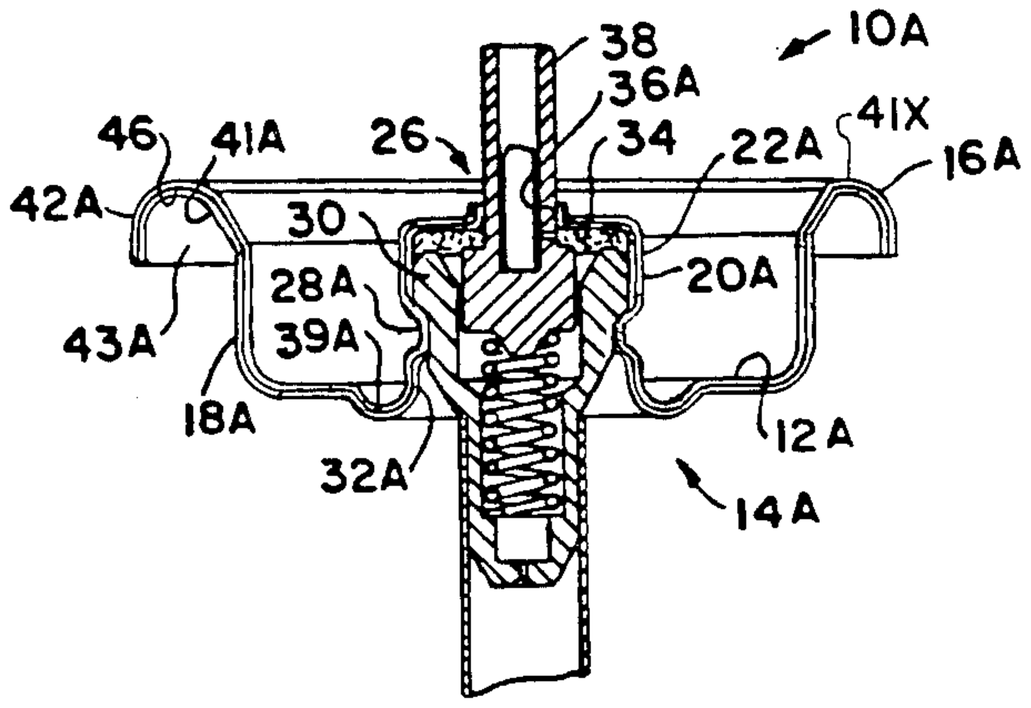

FIG. 5

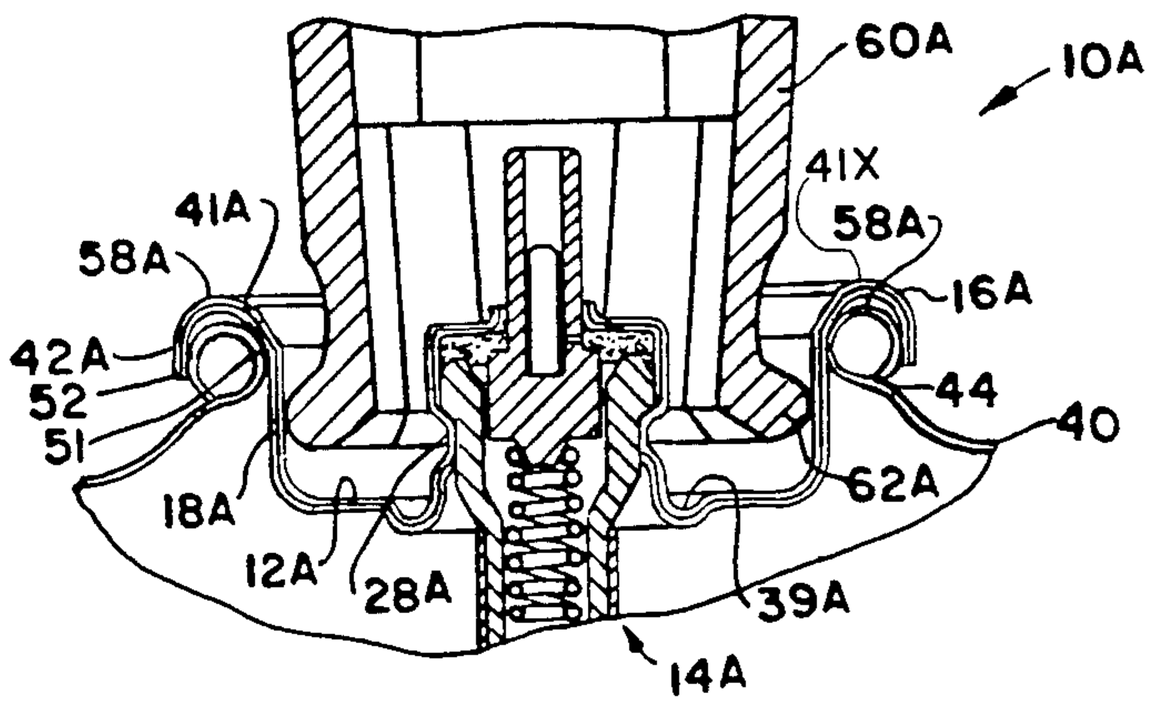

FIG. 6

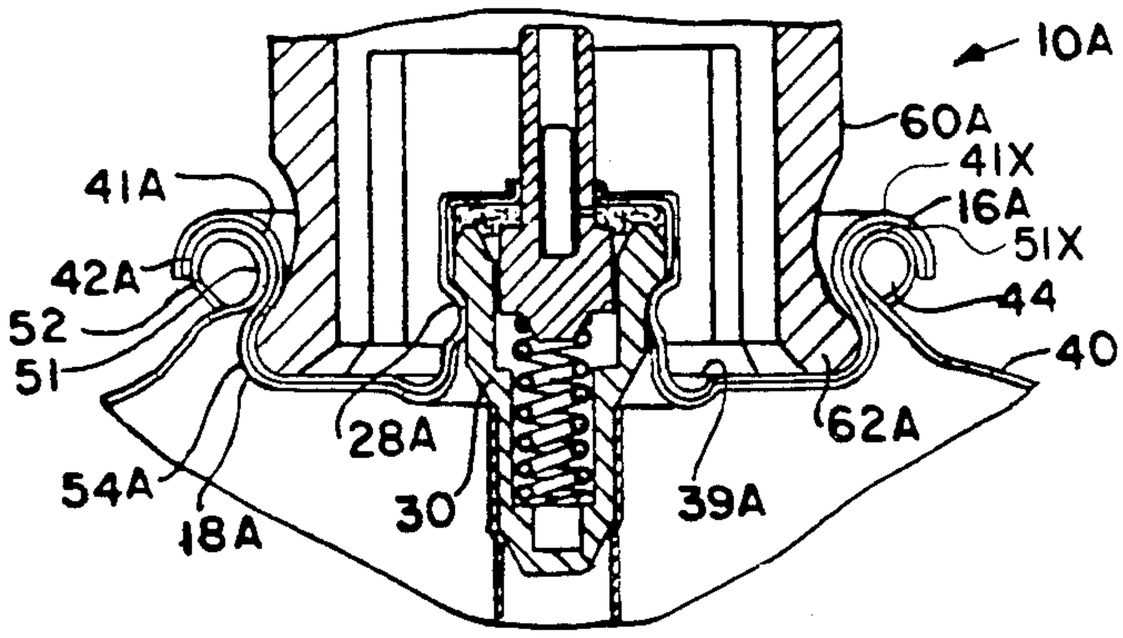

FIG. 7

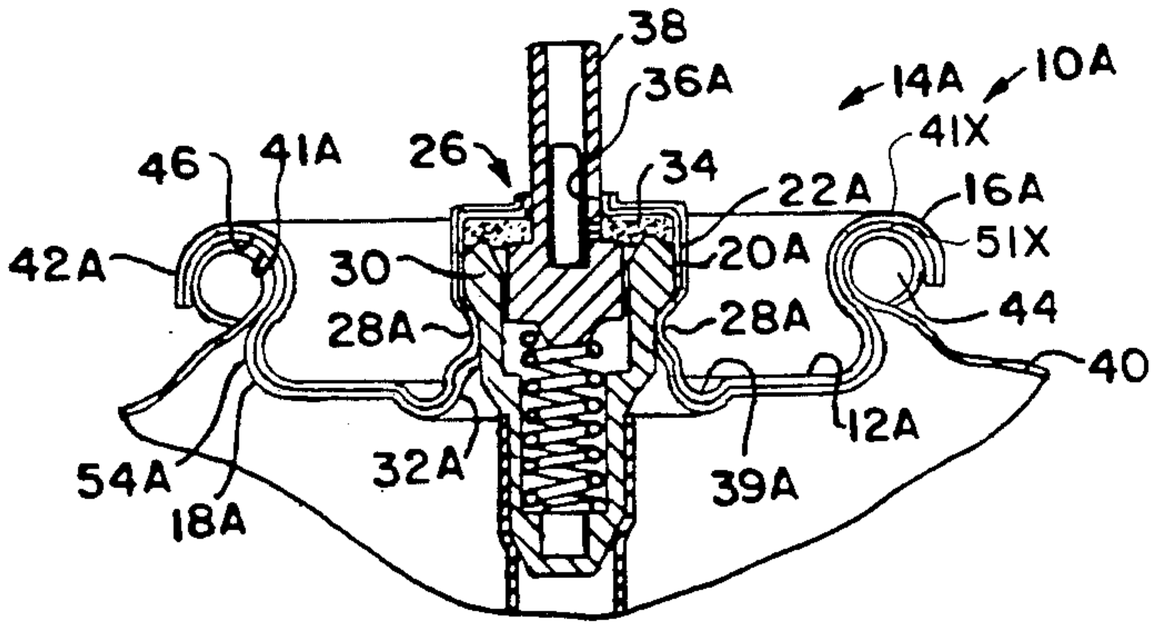

FIG. 8

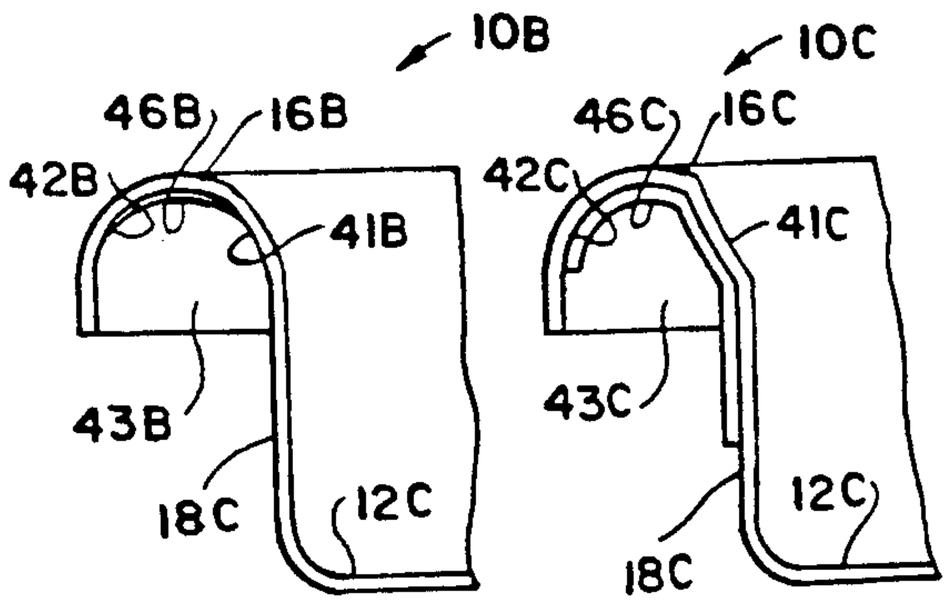

FIG. 9

FIG. 10

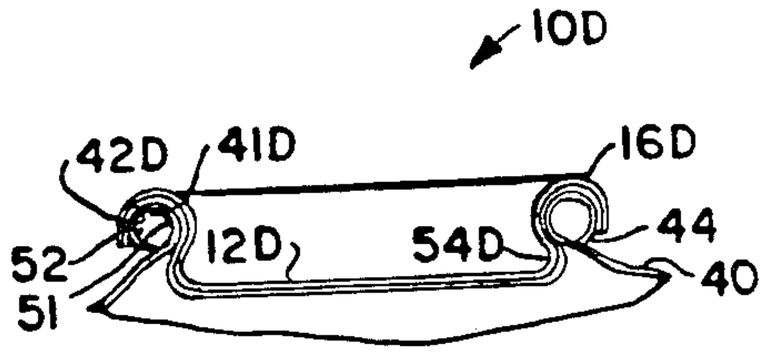

FIG. 11

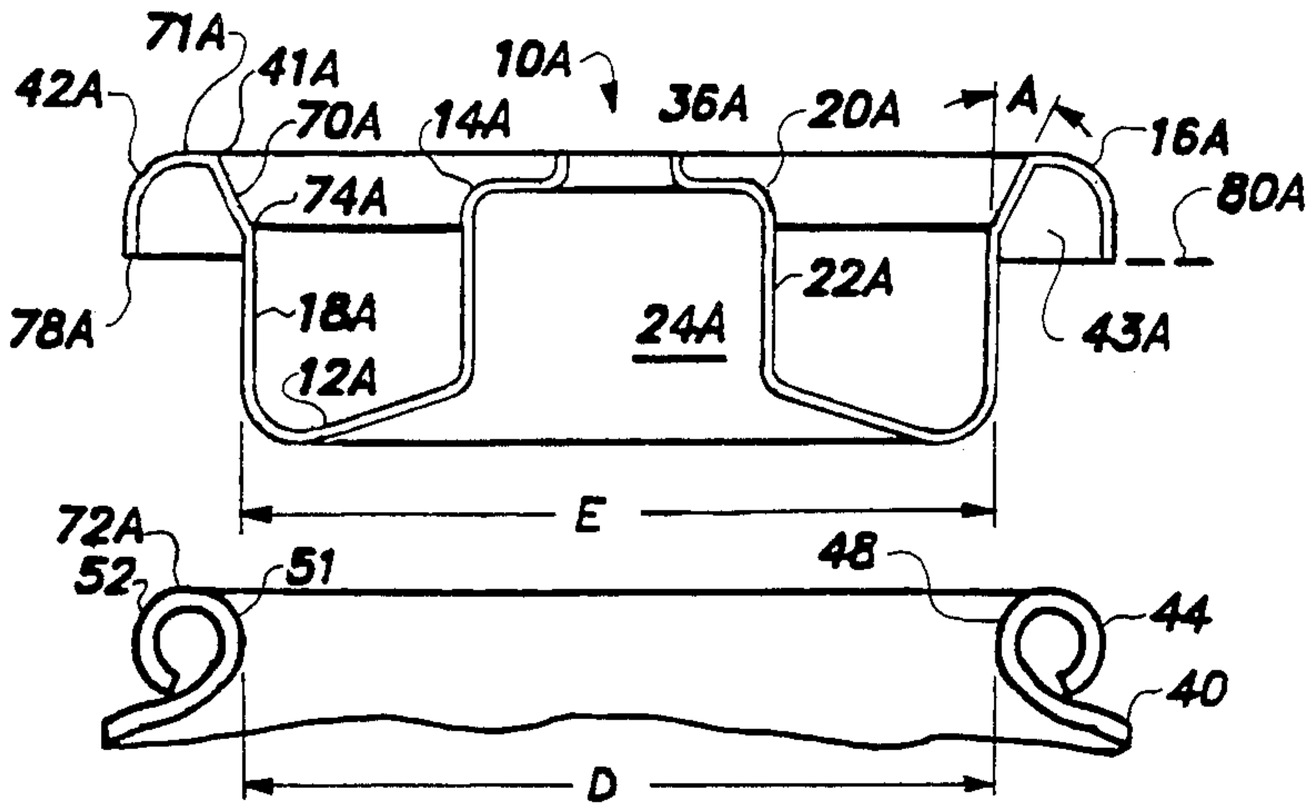

FIG. 12

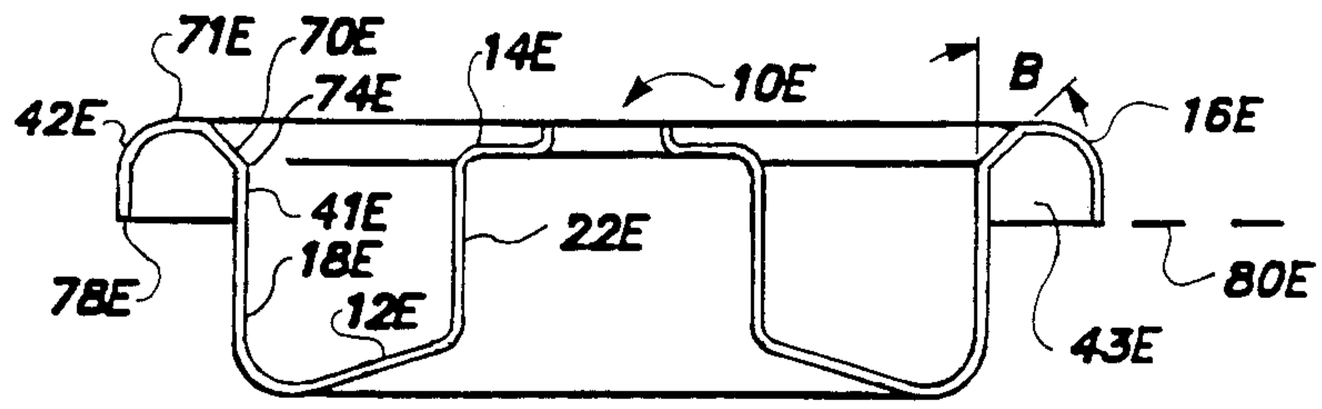

FIG. 13

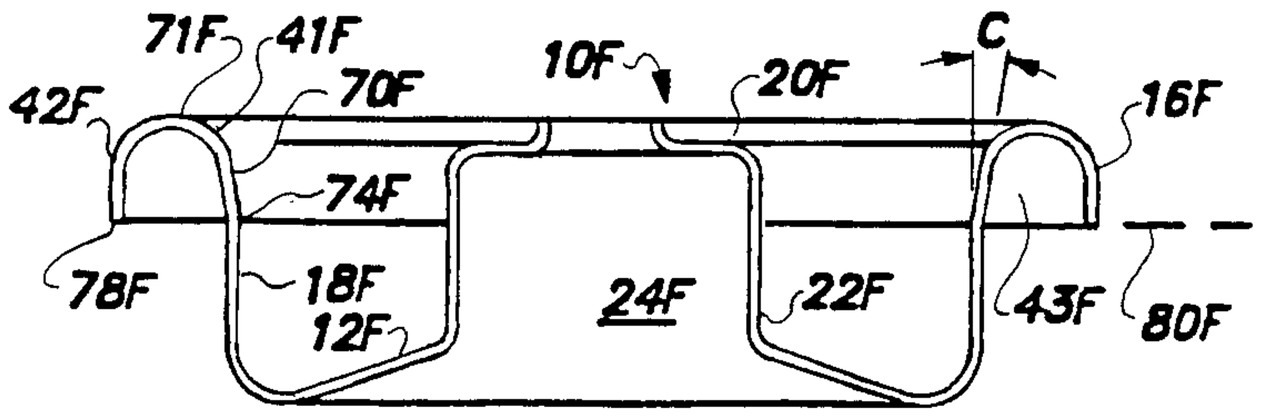

FIG. 14

MOUNTING CUP

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of application Ser. No. 733,207 filed May 13, 1985. All subject matter set forth in application Ser. No. 733,207 filed May 13, 1985 is hereby incorporated into the present application.

BACKGROUND OF THE INVENTION

1. Field Of The Invention

This invention relates to dispensing and more particularly to aerosol dispensing devices incorporating a mounting cup or a closure for sealing with an aerosol container of the aerosol dispensing device.

2. Information Disclosure Statement

Aerosol containers and aerosol mounting cups have been so well known and so well established in the prior art that the basic shape and the basic dimensions of the aerosol containers and the mounting cups are standard in the aerosol industry. In the aerosol industry, an aerosol container is typically made of tin plated steel or aluminum and is provided with an opening in the container encircled by an annular bead for sealing with a peripheral rim formed in the mounting cup. The mounting cup receives an aerosol valve assembly for providing fluid communication between the interior of the aerosol container and the exterior of the aerosol container upon activation of the aerosol valve assembly by a user. The prior art has produced various types of aerosol valves, aerosol valve mechanisms, aerosol dispensing buttons, aerosol dispensing spouts, aerosol overcaps, and various other aerosol dispensing mechanisms for use with a variety of aerosol products as should be well known among those skilled in the art.

The aerosol valve mechanism and the mounting cup is typically fabricated at a valve assembly plant and shipped to a filling plant whereat the valve mechanism and mounting cup is sealed to the aerosol container with the aerosol product and the propellant retained therein. The mounting cup has a peripheral rim which is capable of being crimped to an annular bead located on the aerosol container to establish a seal between the mounting cup and the aerosol container. A plastic or rubber sealing material is located on the peripheral rim of the mounting cup for insuring the sealing engagement between the peripheral rim of the mounting cup and the annular bead of the aerosol container. The peripheral rim of the mounting cup is formed in a substantially inverted U-shaped configuration with the sealing material located in an interior space of the inverted U-shaped peripheral rim. The peripheral rim of the mounting cup is placed upon the annular bead of the aerosol container with the sealing material disposed therebetween. The mounting cup is then deformed or crimped by an expanding collet to bring the peripheral rim of the mounting cup into sealing engagement with the annular bead of the aerosol container.

In the past, numerous sealing materials and sealing devices have been proposed by the prior art for enhancing the seal between the peripheral rim of the mounting cup and the annular bead of the aerosol container. One of the first sealing materials utilized was a cured in place sealing material wherein a liquid sealing material was applied to an interior surface of the peripheral rim of the mounting cup. The liquid sealing material was cured through a sequence of curing ovens to evaporate volatile solvents from the liquid sealant material to leave a resilient residue on the interior surface of the peripheral rim for providing a fluid tight seal when the peripheral rim of the mounting cup was crimped to the annular bead of the aerosol container.

Others in the prior art have utilized mounting cups formed from a metallic sheet material which had been precoated or laminated with a plastic sealing material. As the mounting cup was formed from the laminated plastic and metallic sheet material, the laminated plastic sealing material was located within the peripheral rim of the mounting cup to provide a seal when the mounting cup was secured or crimped to the aerosol container.

Another proposal in the prior art for a mounting cup sealing material was the use of a preformed sleeve of plastic material which was inserted onto the peripheral rim of the mounting cup. The performed sleeve of plastic material is set forth in the published European Patent Application under Ser. No. 0,033,626.

Another proposal in the prior art for a mounting cup sealing material is set forth in the Patent Cooperation Treaty Published Patent Application Ser. No. PCT/US83/01463 wherein a heated mounted cup was immersed within a vessel containing plastic particulate material. A thin coating of the plastic particulate material was thereby affixed to the heated mounting cup. The mounting cup with the affixed thin coating of the plastic particulate material was then removed from the vessel and was heated to produce a uniform coating of plastic sealing material on the interior surface of the peripheral rim of the mounting cup.

Although various proposals have been made in the prior art to improve the seal between the peripheral rim of the mounting cup and the annular bead of the aerosol container, little or no effort has been undertaken to improve the shape or configuration of the mounting cup. The seal between the peripheral rim of the mounting cup and the annular bead of the aerosol container remains of great concern to both the valve assembly plants and the filling plants since the seal between the mounting cup and the aerosol container must be capable of being gas tight for a period of years. In addition, the seal between the mounting cup and the aerosol container must be low in cost to enable aerosol products to be competitive with non-aerosol products in the consumer market.

The problem is further complicated by the fact that the various sealing materials namely, the cured in place sealing material, the plastic sleeve material, the laminated plastic sealing material, and the plastic particulate sealing material all have different thickness which may vary beyond the normal tolerances of the mounting cup and the annular bead of the aerosol container. Furthermore, although quality control is paramount in the aerosol industry, the peripheral rims of the mounting cups manufactured by the valve assembly plants and the annular beads of the aerosol container manufactured by container plants have nominal variations which are within quality control limits. In some cases, the difference in thickness of the plastic sealing materials and the nominal variations of the peripheral rims of the mounting cups and/or the annular beads of the containers are compounded to produce a defective seal in a completed aerosol product which may remain undetected until discovered by the ultimate consumer.

Accordingly, it should be realized that the seal between the mounting cup and the aerosol container is of prime importance to the aerosol industry. Furthermore, since the size and the shape of the annular bead of the aerosol container and the size and the shape of the mounting cup have been virtually unchanged for more than twenty years, it is not surprising that substantially all of the effort to enhance the seal between the mounting cup and the aerosol container has been directed to the sealing material located between the aerosol container and the mounting cup.

Therefore, it is an object of the present invention to provide an improved mounting cup for sealing with a container of an aerosol device wherein the peripheral rim of the mounting cup comprises an improved inner region contour which is deformed when the mounting cup is crimped to the annular bead of the aerosol container.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device wherein the improved inner region contour of the peripheral rim of the mounting cup allows only a portion of the peripheral rim to contact the annular bead of the container when the mounting cup is disposed on the container and which inner region contour of the peripheral rim is reformed to be substantially the same shape as the contour of the annular bead when the mounting cup is crimped to the aerosol container.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device wherein the improved inner region contour of the peripheral rim of the mounting cup adjusts for variations in the dimensions in the mounting cup peripheral rim and adjusts for variations in the dimensions in the annular bead of the container to provide a superior seal therebetween.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device which is suitable for use with a cured in place sealing material, a preformed plastic sleeve material, a laminated sealing material, a plastic particulate sealing material and all other types of sealing materials used in the aerosol industry.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device which comprises a new mounting cup shape prior to the crimping process but which has a conventional mounting cup shape subsequent to the crimping and sealing of the peripheral rim of the mounting cup to the annular rim of the aerosol container.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device wherein the improved mounting cup may be used with conventional crimping equipment in the aerosol industry.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device wherein the peripheral rim of the improved mounting cup has an initial shape substantially different from the shape of the annular bead of the container and which peripheral rim is reformed during the crimping process to have substantially the same shape as the annular bead ot the aerosol container.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol which is suitable for use with all existing aerosol valves.

Another object of this invention is to provide an improved mounting cup for sealing with a container of an aerosol device wherein the improved mounting cup provides a superior seal independent of the sealing material without any additional cost in the fabrication of the mounting cup.

Another object of this invention is to provide an improved method for forming a seal between a mounting cup and a container of an aerosol device wherein the crimping of the mounting cup reforms the peripheral rim of the mounting cup to be substantially the same shape as the contour of the annular bead of the aerosol container to provide a sealing engagement between the mounting cup and the aerosol container.

The foregoing has outlined some of the more pertinent objects of the present invention. These objects should be construed as being merely illustrative of some of the more prominent features and applications of the invention. Many other beneficial results can be obtained by applying the disclosed invention in a different manner or modifying the invention within the scope of the invention. Accordingly other objects in a full understanding of the invention may be had by referring to the summary of the invention, the detailed description describing the preferred embodiment in addition to the scope of the invention defined by the claims taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The present invention is defined by the appended claims with specific embodiments being shown in the attached drawings. For the purpose of summarizing the invention, the invention relates to an improved mounting cup for sealing with a container of an aerosol device, the container having an annular bead extending about an opening in the container and with the annular bead having an inner surface contour. The invention comprises a mounting cup having a peripheral rim for sealing with the annular bead of the container. The peripheral rim has an inner region contour being substantially different in shape from the inner surface contour of the annular bead of the container. The difference in the shape of the inner region contour of the peripheral rim from the shape of the inner surface contour of the annular bead allows only a portion of the inner region contour of the peripheral rim to contact the inner surface contour of the annular bead when the mounting cup is disposed on the container. The shape of the inner region contour of the peripheral rim is deformed when the mounting cup is crimped to the annular bead of the container. The deformation of the inner region contour reforms the shape of the inner region contour to be substantially the same shape as the inner surface contour of the annular bead to provide a sealing engagement between the mounting cup and the container.

In a more specific embodiment of the invention, the mounting cup is preferably formed of a material which is substantially more ductile than the material forming the annular bead of the container. Preferably, a sealing material is secured to the inner region contour of the peripheral rim for sealing any voids between the inner region contour of the peripheral rim and the inner surface contour of the annular bead when the mounting cup is crimped to the container.

In one embodiment of the invention, the inner surface contour of the annular bead has a generally partially circular cross-section defining a bead radius of curva-

ture. The inner region contour of the peripheral rim has a rim radius of curvature substantially greater than the bead radius of curvature of the annular bead. The inner region contour of the peripheral rim may be provided with a generally flattened or slightly curved cross-section for allowing only a circular portion of the inner region contour of the peripheral rim to contact the inner surface contour of the annular bead when the mounting cup is disposed on the container.

The mounting cup includes a sidewall extending between a central area and the peripheral rim with the crimping of the mounting cup to the annular bead including the enlargement of the sidewall adjacent the annular bead to deform the inner region contour of the peripheral rim against the inner surface contour of the annular bead whereby the inner region contour of the peripheral rim is reformed into the shape of the inner surface contour of the annular bead and is established into sealing engagement therewith.

The invention is also incorporated into the method of forming a seal between a mounting cup and a container of an aerosol dispensing device. The container has an annular bead extending about an opening in the container with the annular bead having an inner surface contour. The method includes firstly, forming a peripheral rim in the mounting cup with the peripheral rim having an inner region contour being substantially different in shape from the inner surface contour of the annular bead of the container. Secondly, the peripheral rim of the mounting cup is placed on the annular bead of the container. Thirdly, the mounting cup is crimped in proximity to the inner region contour of peripheral rim to reform the inner region contour of the peripheral rim to be substantially the same shape as the inner surface contour of the annular bead to provide a sealing engagement between the mounting cup and the container.

The foregoing has outlined rather broadly the more pertinent and important features of the present invention in order that the detailed description that follows may be better understood so that the present contribution to the art can be more fully appreciated. Additional features of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and the specific embodiments disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description taken in connection with the accompanying drawings in which:

FIG. **1** is a side sectional view of a prior art mounting cup for an aerosol dispensing device;

FIG. **2** is a side sectional view of an aerosol dispensing mechanism including the prior art mounting cup shown in FIG. **1** disposed upon an aerosol container;

FIG. **3** is a side sectional view of the aerosol dispensing mechanism including the prior art mounting cup shown in FIG. **1** secured to the aerosol container;

FIG. **4** is a side sectional view of a first embodiment of an improved mounting cup of the present invention;

FIG. **5** is a side sectional view of an aerosol dispensing mechanism including the improved mounting cup of FIG. **4**;

FIG. **6** is a side sectional view of the aerosol dispensing mechanism including the improved mounting cup of FIG. **4** being disposed upon an aerosol container;

FIG. **7** is a side sectional view of the aerosol dispensing mechanism including the improved mounting cup of FIG. **4** being secured to the aerosol container;

FIG. **8** is a side sectional view of the completed aerosol device with the aerosol dispensing mechanism of FIG. **5** shown secured to the aerosol container;

FIG. **9** is a side sectional view of a second embodiment of the improved mounting cup of the present invention;

FIG. **10** is a side sectional view of a third embodiment of the improved mounting cup of the present invention;

FIG. **11** is a side sectional view of a fourth embodiment of the improved mounting cup of the present invention shown secured to an aerosol container;

FIG. **12** is an enlarged side sectional view of the first embodiment of an improved mounting cup of the present invention showing an angle of thirty degrees;

FIG. **13** is an enlarged side sectional view of a variation of the first embodiment of the improved mounting cup of the present invention showing an angle of forty-five degrees; and

FIG. **14** is an enlarged side sectional view of another variation of the first embodiment of the improved mounting cup of the present invention showing an angle of ten degrees.

Similar reference characters refer to similar parts throughout the several Figures of the drawings.

DETAILED DISCUSSION

FIG. **1** is a side sectional view of a prior art mounting cup **10** having a substantially flat base **12** disposed in a central area **14** with a peripheral rim **16** being integrally connected to the base **12** by a sidewall **18**. The mounting cup **10** is shown including a mounting cup turret **20** formed in the central area **14** of the mounting cup **10**. The mounting cup turret **20** is formed by sidewalls **22** for defining an interior cavity **24** of the turret **20** for accommodating an aerosol valve assembly **26** shown in FIGS. **2** and **3**. The aerosol valve assembly **26** is crimped to the mounting cup **10** by crimps **28** with a valve body **30** of the aerosol valve assembly **26** being sealed to an internal surface **32** of the mounting cup **10** by a gasket **34**. The mounting cup turret **20** also includes a valve stem orifice **36** for enabling a valve stem **38** to extend therethrough to provide fluid communication between the interior and the exterior of the aerosol device. An optional annular lip **39** is included for providing additional material to the mounting cup **10** when the mounting cup **10** is crimped to an aerosol container **40** as will be described in greater detail hereinafter. The aerosol valve assembly **26** is shown in FIGS. **2** and **3** without a valve button or an overcap but the operation of the aerosol valve assembly **26** shoudl be well known to those skilled in the art and for the sake of clarity will not be further explained herein.

The peripheral rim **16** of the prior art mounting cup **10** is substantially an inverted U-shape having an inner region contour **41** and an outer region contour **42** which are generally partially circular in configuration defining an internal space **43** for receiving an annular bead **44** of the aerosol container **40** therein. The interior surface **32** of the mounting cup **10** in this embodiment is provided

with a sealing material **46** for providing a fluid-tight seal between the peripheral rim **16** and the annular bead **44** of the aerosol container **40**.

The annular bead **44** extends about an opening **48** in the aerosol container **40** with the annular bead **44** being rolled into the configuration as shown in FIGS. **2** and **3** thereby defining an inner surface contour **51** proximate the opening **48** of the aerosol container **40** and an outer surface contour **52** remote from the opening **48** in the aerosol container **40**. The annular bead **44** has a generally circular cross-section such that the inner surface contour **51** and the outer surface contour **52** are partially circular in cross-section as shown in FIGS. **2** and **3**. In the prior art mounting cup **10**, the inner region contour **41** and the outer region contour **42** has a radius of curvature substantially equal to the radius of curvature of the inner surface contour **51** and the outer surface contour **52**, respectively, to enable the internal space **43** of the peripheral rim **16** to fully receive the annular bead **44**. The annular bead **44** is typically constructed of a type T-2 or type T-3 tin-coated steel whereas the mounting cup **10** is made of a more ductile material such as type D T-1 tin-plated steel.

FIG. **2** illustrates the prior art mounting cup **10** being disposed upon the annular bead **44** of the aerosol container **40**. As it can be clearly seen from FIG. **2**, the inner region contour **41** and the outer region contour **42** of the peripheral rim **16** of the mounting cup **10** respectively engage the inner surface contour **51** and the outer surface contour **52** of the annular bead **44** of the aerosol container **40**. In addition, virtually the entire internal space **43** of the peripheral rim **16** is occupied by the annular bead **44** of the container **40**. Accordingly, in the prior art mounting cup **10**, the inner region contour and the outer region contour **41** and **42** were specifically formed to fit with the inner surface contour and the outer surface contour of **51** and **52** of the annular bead **44** and to minimize any voids within the internal space **43**.

FIG. **3** illustrates prior art mounting cup **10** secured to the aerosol container **40**. The sidewall **18** of the mounting cup **10** is deformed by an expansion collet (not shown) to produce a mounting cup crimp **54** adjacent the annular bead **44** of the aerosol container **40** to provide a sealing engagement between the mounting cup **10** and the aerosol container **40**.

The prior art mounting cup **10** has been formed in the shape as shown in FIGS. **1–3** for many decades since it was believed that a contacting fit as shown in FIG. **2** was the most advantageous to create a seal between the peripheral rim **16** and the annular bead **44**. Accordingly, the majority of efforts of the prior art to improve the seal between the mounting cup **10** and the aerosol container **40** were concentrated into improving the sealing material **46** between the peripheral rim **16** and the annular bead **44**.

FIG. **4** is a side sectional view of a first embodiment of a mounting cup **10A** of the present invention comprising a substantially flat central base **12A** disposed in a central area **14A** with a peripheral rim **16A** being integrally connected to the base **12A** by a sidewall **18A**. The mounting cup **10A** is shown including a mounting cup turret **20A** formed in the central area **14A** of the mounting cup **10A**. The mounting cup turret **20A** is formed by sidewalls **22A** for defining an interior cavity **24A** of the turret **20A** for accommodating the aerosol valve assembly **26** shown in FIGS. **5–8**. The aerosol valve assembly **26** is identical to the aerosol valve assembly **26** shown in FIGS. **2** and **3** but it should be understood that any valve assembly incorporating a mounting cup or any valveless mounting cup is suitable for use with the present invention. The aerosol valve assembly **26** is crimped to the mounting cup **10A** by crimps **28A** with the valve body **30** of the aerosol valve assembly **26** being sealed to an interior surface **32A** of the mounting cup **10A** by a gasket **34**. The mounting cup turret **20A** also includes a valve stem orifice **36A** for enabling the valve stem **38** to extend therethrough to provide fluid communication between the interior and the exterior of the aerosol device. An optional annular lip **39A** is included for providing additional material to the mounting cup **10A** when the mounting cup is crimped to the aerosol container **40**.

The peripheral rim **16A** of the improved mounting cup **10A** has an inner region contour **41A** and an outer region contour **42A** defining an interior space **43A** for cooperating with the annular bead **44** of the aerosol container **40**. In this embodiment the interior surface of the mounting cup **32A** is provided with a sealing material **46** defining the inner region contour **41A** and the outer region contour **42A** and to provide a fluid-tight seal between the peripheral rim **16A** and the annular bead **44** of the aerosol container **40**.

The outer region contour **42A** of the peripheral rim **16A** of the improved mounting cup **10A** is generally partially circular in cross-section in a manner similar to the outer region contour **42** of the peripheral rim **16** of the prior art mounting cup **10** shown in FIGS. **1–3**. In addition, the outer region contour **42A** of the peripheral rim **16A** has a radius of curvature substantially equal to the radius of curvature the outer surface contour **52** of the annular bead **44**.

As can be clearly seen from FIG. **4**, the inner region contour **41A** of the peripheral rim **16A** of the improved mounting cup **10A** is substantially different in shape from the inner surface contour **51** of the annular bead **44**. The inner region contour **41A** of the peripheral rim **16A** of the improved mounting cup **10A** shown in FIG. **4**, extends into the interior space **43** normally defined by the peripheral rim **16** of the prior art mounting cup **10** shown in FIG. **1**. In the embodiment shown in FIG. **4**, the inner region contour **41A** comprises a flattened annular surface having a substantially linear cross-section and angularly disposed relative to the sidewall **18A** of the mounting cup **10A**. The substantially linear region forms an angle A of approximately 30 degrees relative to the sidewall **18A**. Since the inner region contour **41A** is shown as a linear tapered region, the radius of curvature of the inner surface region **41A** is infinite but it should be understood that the inner surface contour **41A** may be slightly curved about a large radius of curvature or may be convexly curved into the interior space **43A** of the peripheral rim **16A** to accomplish the intended purpose of the invention.

In a manner identical to FIGS. **2** and **3**, the annular bead **44** shown in FIG. **6** extends about an opening **48** in the aerosol container **40** with the annular bead **44** having an inner surface contour **51** proximate the opening **48** of the aerosol container **40** and an outer surface contour **52** remote from the opening **48** in the aerosol container **40**. The annular bead **44** has a generally circular cross-section such that the inner surface contour **51** and the outer surface contour **52** are generally partially circular in cross-section as shown in FIGS. **5–8**.

FIG. **6** illustrates the mounting cup **10A** being disposed upon the aerosol container **40** with the peripheral

rim **16A** engaging the annular bead **44**. As it can be clearly seen from FIG. **6**, the inner region contour **41A** forms an interference fit with the inner surface contour **51** to inhibit the complete seating of the mounting cup **10A** on the annular bead **44** in contrast to the prior art shown in FIG. **2**. The inner region contour **41A** of the peripheral rim **16A** allows only a portion of the inner region contour **41A** to contact the inner surface contour **51** of the annular bead **44**. Accordingly, only a circular portion of the inner region contour **41A** of the peripheral rim **16A** contacts the inner surface contour **51** of the annular bead when the mounting cup **10A** is disposed on the aerosol container **40**. Furthermore, the internal space **43A** of the improved mounting cup **10A** does not fully receive the annular bead **44** as the prior art mounting cup **10**. In contrast to the prior art mounting cup **10**, a void **58A** is created between the peripheral rim **16A** and the annular bead **44** as shown in FIG. **6**. The interference fit between the inner region contour **41A** and the inner surface contour **51** prohibits a rim apex **41X** located at the intersection of the inner region contour **41A** and the outer region contour **42A** from contacting a bead apex **51X** located at the intersection of the inner surface contour **51** and the outer surface contour **52**.

FIG. **6** also illustrates an expandable collet **60A** having an annular collet head **62A** for crimping the mounting cup **10A** into sealing engagement with the aerosol container **40**. The internal space **43** of the peripheral rim **16** of the prior art mounting cup **10** completely received the annular bead **44** as shown in FIG. **3** and was believed to provide the proper seating of the peripheral rim **16** on the annular bead **44** prior to the crimping process. The internal space **43A** of the peripheral rim **16A** of the mounting cup **10A** of the present invention does not completely receive the annular bead **44** as shown in FIG. **6** prior to the crimping process. In view of the improved inner region contour **41A** of the peripheral rim **16A** of the present invention inhibiting the complete reception of the annular bead **44**, one would expect that an improper seal would be created between the improved mounting cup **10A** and the aerosol container **40**. However, in contrast to what one would expect, the use of the improved inner region contour **41A** to inhibit the peripheral rim **16A** from completely receiving the annular bead **44** as shown in FIG. **6** produces an enhanced and more reliable seal than heretofore known in the art.

FIG. **7** is a side sectional view illustrating the sealing engagement between the inner region contour **41A** of the peripheral rim **16A** of the mounting cup **10A** and the annular bead **44** of the aerosol container **40**. In this embodiment, the expandable collet **60A** has been moved radially outwardly for enabling the annular collet head **62A** to form a crimp **54A** in the sidewall **18A** of the mounting cup **10A**. Simultaneously therewith, the expandable collet head **62A** has reformed the inner region contour **41A** to approximate the generally partial circular cross-section of the inner surface contour **51** of the annular bead **44**. As the inner region contour **41A** of the peripheral rim **16A** is reformed into conformity with the inner surface contour **51** of the annular bead **44**, the mounting cup **10A** is brought into sealing engagement with the aerosol container **40**. During the deforming process, the base **12A** of the mounting cup **10A** is raised in FIG. **7** to provide additional material to form the crimp **54A**. Simultaneously therewith, the inner region contour **41A** is drawn downwardly in FIG. **7** to a position whereat the inner region contour **41A** of the mounting cup **10A** provides a mating engagement with the inner surface contour **51** of the annular bead **44**. The deformation of the mounting cup **10A** during crimping reforms the inner region contour **41A** over the surface of the inner surface contour **51** and moves the rim apex **41X** into close proximity or contact with the bead apex **51X**.

After formation of the crimp **54A** shown in FIG. **7**, the collet heads **62A** are moved radially inwardly to a position as shown in FIG. **6** and are removed to provide the finished aerosol dispensing device as shown in FIG. **8**. As it can be seen from an examination of FIGS. **3** and **8**, the outward appearance of the peripheral rim **16A** of the improved mounting cup **10A** of the present invention is substantially the same as the outward appearance of the peripheral rim **16** of the prior art mounting cup **10**. Accordingly, after crimping of the improved mounting cup **10A**, the mounting cup **10A** appears to be identical to the prior art mounting cup **10** to the casual observer.

In the prior art process, the peripheral rim **16** of the mounting cup **10** is positioned for complete contact with the annular bead **44** as shown in FIG. **2**. In the event of a significant variation in the size or the shape of the peripheral rim **16** and/or the annular bead **44**, a void is produced between the peripheral rim **16** and the annular bead **44**. During the crimping of the prior art mounting cup **10**, there is only little downward movement of the inner region contour **41** of the peripheral rim **16** relative to the annular bead **44** in FIG. **2**. Thus leaks may develop between the peripheral rim **16** and the annular bead **44** at the point or points of the significant variation in the size or the shape of the peripheral rim **16** and/or the annular bead **44**.

In the improved mounting cup **10A** of the present invention, the inner region contour **41A** of the peripheral rim **16A** inhibits the peripheral rim **16A** from completely contacting the annular bead **44** in contrast to the prior art mounting cup **10**. Accordingly, during the crimping of the improved mounting cup **10A**, there is significant downward movement of the inner region contour **41A** of the peripheral rim **16A** relative to the annular bead **44**. The inner region contour **41A** is drawn downwardly in FIG. **7** during the deformation process to a position whereat the inner region contour **41A** is brought into tight engagement with the annular bead **44**. The deformation process of the improved mounting cup **10A** compensates for any variations in the size or the shape of the peripheral rim **16A** and/or the annular bead **44** since the entire inner region contour **41A** is selectively deformed during the crimping process. Accordingly, the peripheral rim **16A** may be deformed to a greater degree or a lesser degree at the point or points of the significant variation in the size or the shape of the peripheral rim **16A** and/or the annular bead **44**. In contrast, the prior art sealing process relied on a complete and uniform contact of the peripheral rim **16** of the mounting cup **10** to the annular bead **44** prior to the crimping process as shown in FIG. **2**. Thereafter, the prior art mounting cup was uniformly crimped without regard for any significant variation in the size or the shape of the peripheral rim **16** and/or the annular bead **44**. The inner region contour **41A** of the peripheral rim **16A** functions as a wedge during the crimping process whereby the expandable collet head **62A** will deform and draw down the peripheral rim **16A** of the mounting cup **10A** into sealing engagement with the annular bead

44 of the container 40. During the crimping process, the annular bead 44 of the container 40 functions as a fulcrum to reform the inner region contour 41A of the peripheral rim 16A. After the crimping process is completed, the inner region contour 41A remains in tight intimate contact with the annular bead 44 of the container 40 regardless of any nominal manufacturing variations that may be present in the peripheral rim 16A and/or the annular bead 44 of the container 40.

The present invention has been found useful with virtually any presently available aerosol valve dispensing devices incorporating a mounting cup as well as numerous types of cans or containers having an annular bead 44. The present invention also provides superior seals on containers constructed of different types of materials including but not limited to ferrous and non-ferrous metals.

FIG. 9 is a side sectional view of a portion of the improved mounting cup 10B wherein the inner region contour 41B is shown as a curve having a radius of curvature greater than the radius of curvature of the outer region contour 42B. In addition, FIG. 9 illustrates the use of a cured in place sealing material 46B as heretofore described.

FIG. 10 is a side sectional view of a portion of the improved mounting cup 10C wherein the inner region contour 41C is a curved surface which convexly extends into the internal space 43C of the peripheral rim 16C.

FIG. 11 is a side sectional view illustrating the invention being applied to a valveless mounting cup 10D. The nature and use of the valveless mounting cup 10D should well known to those skilled in the art.

FIG. 12 is a side sectional view of the preferred embodiment of the invention shown in FIGS. 6–8. The annular bead 44 of the aerosol container 40 defines the opening 48 of the aerosol container 40 which opening has an inner diameter D which diameter is typically is 1.000 inches in the United States. The sidewall or outer periphery 18A of the improved mounting cup 10A is typically established in the industry to have an outer diameter E between 0.992 inches and 0.994 inches. The outer diameter E of the sidewall 18A is smaller than the inner diameter D of the opening 48 in the aerosol container 40 for enabling the introduction of propellant into the aerosol container 40 between the outer diameter E of the sidewall 18A and the inner diameter D of the opening 48 in the aerosol container 40 when the mounting cup 10A is placed over the aerosol container 40 as should be well known to those skilled in the art. Angle A of a linear portion 70A of inner region contour 41A is established at 30° relative to the sidewall 18A. A linear portion 70A of the inner region contour 41A is expanded radially outwardly of the outer diameter E of the sidewall 18A to provide a diameter equal to or greater to the inner diameter D of the opening 48 in the aerosol container 40. When the improved mounting cup 10A is moved downwardly onto the aerosol container 40, the radially expanded linear portion 70A of the inner region contour 41A of the peripheral rim 16A contacts the inner surface contour 51 of the annular bead 44 of the aerosol container 40. As it can be clearly seen from FIG. 6, an interference fit occurs between between the inner region contour 41A and the inner surface contour 51 prior to a central area or apex 71A of the peripheral rim 16A contacting a central area or apex 72A of the annular bead 44. Accordingly, the outer diameter E of the sidewall 18A is of a size to enable the flow of propellant between the outer diameter E of sidewall 18A and the inner diameter D of the opening 48 whereas the inner region contour contour 41A has an outer diameter which is equal to or greater to the inner diameter D of the annular bead 44 to provide the interference fit therebetween. The interference fit between the inner region contour 41A and the inner surface contour 51 is believed in part to produce the superior seals produced by the present invention.

FIG. 13 illustrates a variation of the first embodiment wherein the angle B of a linear portion 70E of the inner region contour 41E is established at 45 degrees relative to the sidewall 18E. A termination 74E of the linear portion 70E is located at a higher level relative to the level of the termination 74A of the linear portion 70A of the inner region contour 41A of the embodiment shown in FIG. 12.

FIG. 14 illustrates a further variation of the embodiment shown in FIG. 12 wherein the angle C of the linear portion 70F is established at 10 degrees relative to the sidewall 18F. In this embodiment, the termination 74F of the linear region 70F is disposed along a plane 80F extending through the outer termination 78F of the outer surface contour 42F of the peripheral rim 16F.

Extensive tests have been performed on the mounting cups set forth herein in an attempt to define the critical parameters of operation. All of the mounting cups shown in the present specification have been demonstrated to have substantially less leakage when compared to standard mounting cups using identical sealing materials. It is believed that one of the critical parameter for the operation of the mounting cup is that the outer diameter E of the sidewall 18A is less than the inner diameter D of the opening 48 of the annular bead 44 to enable the introduction of propellant therebetween. Furthermore, the inner region contour 41A which extends between the central area 71A and the plane 80A extending through the outer terminals 78A has at least a portion thereof with a diameter greater than the outer diameter D of the sidewall 18A to enable the intimate contact with the inner surface contour 51 of the annular bead 44 when the mounting cup 10A is placed upon the aerosol container 40. This permits the introduction of the propellant between the inner diameter D of the opening 48 and the outer diameter E of the sidewall 18A when the mounting cup 10A is slightly elevated relative to the annular bead 44 while simultaneously permitting intimate contact between the inner region contour 41A and the inner surface contour 51 of the aerosol container when the mounting cup 10A is positioned on the annular bead 44. It should be appreciated that other variations of the embodiments specified herein may be resorted to for accomplishing the same or similar inventive concept which has produced a vastly superior seal which was heretofore unknown in the prior art.

The present disclosure comprises the forgoing specification and drawings and the appended claims. Although this invention has been described in the preferred form with a certain degree of particularity, it should be understood that the present discloure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. An improved mounting cup for sealing with a container of an aerosol dispensing device, the container having an annular bead extending about an opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer surface contour remote from the opening in the container, comprising in combination:

a mounting cup comprising a central area and an annular side wall;

said annular sidewall supporting a peripheral rim for sealing with the annular bead of the container;

said peripheral rim having an inner region proximate said central area of said mounting cup and an outer region remote from said central area with said inner region and said outer region of said peripheral rim defining a rim apex therebetween;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer surface contour of the annular bead of the container;

said inner region of said peripheral rim having a portion thereof being radially expanded relative to said annular sidewall;

the diameter of said annular sidewall being less than the diameter of the opening in the container for enabling the introduction of aerosol propellant between said annular sidewall and the opening in the container;

said radially expanded portion of said inner region being established for engaging the inner surface contour of the annular bead of the container to inhibit said rim apex of said peripheral rim of said mounting cup from contacting the annular bead of the container when said mounting cup is disposed upon the aerosol container; and

said inner region of said mounting cup being deformed when said mounting cup is sealed to the annular bead of the container to approximate the generally circular cross-section of the inner surface contour of the annular bead and to move the rim apex of the peripheral rim into contact with the bead apex of the annular bead to provide a sealing engagement between said mounting cup and the container, and

said deformation of said inner region of said mounting cup to provide said sealing engagement between said mounting cup and the container being accomplished solely by an outward radial expansion of said sidewall of said mounting cup.

2. An improved mounting cup for sealing with a container of an aerosol device, the container having an annular bead extending about a substantially circular opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer surface contour remote from the opening in the container, comprising:

a mounting cup comprising a central base and a outer periphery;

a peripheral rim integrally connected to said outer periphery of said central area;

said peripheral rim having an inner region contour proximate said central base of said mounting cup and an outer region contour remote from said central base;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer surface contour of the annular bead of the container;

said central area of said mounting cup having a diameter less than the diameter of the circular opening in the container for enabling the introduction of aerosol propellant between said mounting cup and the circular opening in the container when said mounting cup is inserted within the circular opening of the container;

said outer periphery of said mounting cup having a radially outwardly expanded portion for providing an interference fit with the inner surface contour of the annular bead of the container to allow only partial insertion of said central base of said mounting cup within the aerosol container and for inhibiting said outer region of said peripheral rim from matingly engaging with the outer surface contour of the annular bead of the container;

said radially outwardly expanded portion of said outer periphery being deformed to eliminate said interference fit with the inner surface contour of the annular bead and being reformed to be substantially the same as the inner surface contour of the annular bead to provide a sealing engagement between said mounting cup and the container when said mounting cup is crimped to the annular bead of the container

said reforming of said radially outwardly expanded portion of said outer periphery during crimping causing said central base of said mounting cup to be completely inserted within the aerosol container and causing said outer region of said peripheral to be moved into matingly engagement with the outer surface contour of the annular bead of the container; and

said crimping of said mounting cup to the aerosol container being accomplished by the radial expansion of said outer periphery of said mounting cup solely by the application of an radially outward external force and void of any inward external force being applied to the mounting cup.

3. An improved mounting cup for sealing with a container of an aerosol dispensing device, the container having an annular bead extending about an opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer surface contour remote from the opening in the container, comprising in combination:

a mounting cup comprising a central area, a sidewall and a peripheral rim;

said peripheral rim having an inner region contour proximate said sidewall of said mounting cup and an outer region contour remote from said sidewall with said inner region contour and said outer region contour of said peripheral rim defining a rim apex therebetween;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer contour of the annular bead of the container;

the diameter of said sidewall proximate said central area being less than the diameter of the opening in the container for enabling the introduction of aero-

sol propellant between said sidewall and the opening in the container;

said mounting cup having an expanded portion being radially expanded relative to the diameter of said sidewall proximate said central area for engaging with the inner surface contour of the bead of the container when said mounting cup is disposed upon the aerosol container to inhibit said rim apex of said peripheral rim of said mounting cup from contacting the annular bead of the container; and

said inner region contour of said mounting cup being deformed to approximate the generally circular cross-section of the inner surface contour of the annular bead when said mounting cup is sealed to the annular bead of the container;

said rim apex of the peripheral rim being moved into contact with the annular bead when said mounting cup is sealed to the annular bead of the container; and

said sealing of said mounting cup to the annular bead of the container being accomplished solely by the radial outward expansion of said sidewall of said mounting cup.

4. An improved mounting cup for sealing with a container of an aerosol dispensing device, the container having an annular bead extending about a substantially circular opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer surface contour remote from the opening in the container, comprising:

a mounting cup comprising a central base, a sidewall and a peripheral rim;

said peripheral rim having an inner region contour proximate said sidewall of said mounting cup and an outer region contour remote from said sidewall with said inner region contour and said outer region contour of said peripheral rim defining a rim apex therebetween;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer surface contour of the annular bead of the container;

said sidewall of said mounting cup adjacent said central base having a diameter less than the diameter of the circular opening in the container for allowing the mounting cup to be inserted within the circular opening and for enabling the introduction of aerosol propellant between said sidewall and the circular opening in the container;

said mounting cup having an expanded portion being radially expanded relative to said diameter of said annular sidewall proximate said central area for engaging with the inner surface contour of the annular bead of the container to inhibit said rim apex of said peripheral rim of said mounting cup from contacting the annular bead of the container when said mounting cup is disposed upon the aerosol container;

said expanded portion of said mounting cup being deformed to approximate the generally circular cross-section of the inner surface contour of the annular bead with said rim apex of the peripheral rim being moved into contact with the annular bead when said mounting cup is sealed to the annular bead of the container; and

said sealing of said mounting cup to the annular bead of the container being accomplished solely by the radial outward expansion of said sidewall of said mounting cup.

5. A preformed mounting cup for sealing with a container of an aerosol dispensing device, the container having an annular bead extending about a substantially circular opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer surface contour remote from the opening in the container, comprising:

a mounting cup comprising a central base, a sidewall and a peripheral rim;

said peripheral rim having an inner region contour proximate said sidewall of said mounting cup and an outer region contour remote from said sidewall with said inner region contour and said outer region contour of said peripheral rim defining a rim apex therebetween;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer surface contour of the annular bead of the container;

said sidewall of said mounting cup adjacent said central base being dimensionally preformed for allowing the introduction of an aerosol propellant between said sidewall and the opening in the container when the mounting cup is inserted within the opening of the container;

said mounting cup being dimensionally preformed for providing an interference fit with the inner surface contour of the annular bead of the container to inhibit said rim apex of said peripheral rim of said mounting cup from contacting the annular bead of the container;

said said mounting cup being deformed to move said rim apex of the peripheral rim into contact with the annular bead when said mounting cup is sealed to the annular bead of the container; and

said sealing of said mounting cup to the annular bead of the container being accomplished solely by the radial outward expansion of said sidewall of said mounting cup effected solely by the application of an radially outward external force being applied to said sidewall of said mounting cup and void of any inward external force being applied to said outer region counter of said mounting cup.

6. An improved mounting cup for sealing with a container of an aerosol device, the container having an annular bead extending about a substantially circular opening in the container with the annular bead having a generally circular cross-section thereby defining an inner surface contour proximate the opening in the container and an outer contour remote from the opening in the container, comprising:

a mounting cup comprising a central base and an outer periphery;

a peripheral rim integrally connected to said outer periphery with said peripheral rim having an inner region contour proximate said central base of said mounting cup and an outer region contour remote from said central base;

said outer region of said peripheral rim having a partially circular cross-section for matingly engaging with the generally circular cross-section of the outer contour of the annular bead of the container;

said central area of said mounting cup having a diameter less than the diameter of the circular opening in the container for enabling the introduction of aerosol propellant between said mounting cup and the circular opening in the container when said mounting cup is inserted within the circular opening of the container;

said inner region contour of said peripheral rim extending angularly outwardly relative to said central base to form a flattened annular surface at said inner region contour;

said flattened annular surface of said inner region contour of said mounting cup being radially expanded relative to the diameter of the circular opening in the container to allow only partial insertion of said central base of said mounting cup within the aerosol container and to inhibit said outer region contour of said mounting cup from matingly engaging with the outer surface contour of the annular bead of the container;

said flattened annular surface of said inner region contour of said mounting cup being reformed to a substantially the same as the inner surface contour of the annular bead to provide a sealing engagement between said mounting cup and the container when said mounting cup is crimped to the annular bead of the container

said reforming of said flattened annular surface of said inner region contour during crimping causing movement of said central base of said mounting cup into complete insertion within the aerosol container and moving said outer region of said mounting cup into matingly engagement with the outer surface contour of the annular bead of the container; and

said crimping of said mounting cup to the aerosol container being accomplished by the radial expansion of said outer periphery of the mounting cup solely by the application of an radially outward external force and void of any inward external force being applied to the mounting cup.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,813,576

DATED : March 21, 1989

INVENTOR(S) : James E. Greenebaum, II

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 3, line 64, delete "ot" and insert therefor --of--.

Claim 3, column 14, line 65, after "outer" insert --surface--.
Claim 6, column 16, line 68, after "outer" insert --surface--.

Signed and Sealed this

Second Day of January, 1990

Attest:

JEFFREY M. SAMUELS

Attesting Officer

Acting Commissioner of Patents and Trademarks